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We are again indebted to Mr. Jos. E. Bloomfield for an analysis of the annual return of the Massachusetts Railroads.

This is the sixth year for which these tables have been made, and each is of increasing interest as containing the result of more experience.

For the American Railroad Journal and Mechanics' Magazine.]

In presenting you with the 6th table of the annual receipts, expenses, dividends, and cost, of the railways completed in Massachusetts, compiled from the reports of the several railroad companies, for the last six years, to the Legislature, it is to be regretted there are so few new features to remark on. They have pursued a legal form in their returns, without reference to detail, and the working of their roads. The reports however of the *Western railroad—Eastern railroad*, and *Norwich and Worcester railroads*, give us tabular details, highly interesting. The cost, and *working of* the Western railroad, is placed under the several heads, so repeatedly asked for in your valuable Journal.—Their publication, and the form of the table of the superintendents department of the Norwich railroad are models for imitation.

It will be perceived, the cost of the Western railroad to Albany from Worcester, is $7,566,791 for 156 miles of road—with 14 miles of turnout—equal to $48,500 cost per mile.—The Boston and Worcester railroad 44¼ miles, has cost $2,726,102.—Total cost of 200 miles of road $10,292,893. On this road, there were great deficulties to conquer, from the nature of the ground, runing as the line

does, at right angles, with rocky, mountain summits.—One is east of the Conneticut river, at Carlton, 906 feet above the *base* line of the Boston and Worcester railroad in Boston, the other, at Mount Washington, between the Conneticut and Hudson Rivers 1456 feet along the same base line at Boston mill dam and 1480 feet above tide water.

The desire to press forward a large expenditure, to accomplish the wish of the statesmen, who planed this magnificient work, has caused many extra expenses. This is perceived in the cost of depots, and of land for the *right* of *way*. Also in the item of engineering, amounting as it does to $263,105 or near $1700 per mile. The item of land damages, with depots and Stations, consisting of 1648 acres of which 118 acres are for 29 depots, has cost $339,716, exceeding $200 per acre, for 10½ acres to the mile.

This land, for farming purposes, cannot be valued on an average, to exceed $50 per acre. It has been greatly exchanged in value, by this road, affording a ready market for agricultural and manufactured products, yet we find, that the location, prior to the obtaining of releases, or terms, and hot haste with which the work has been forced through, has cost the company $2163 per mile, for "depots, and the right of way,"—although it was considered, at the commencement of the work, that ample grounds had been taken for depots at Springfield and other points, yet the report states "they were found insufficient." At Greenbush, in front of Albany, twenty-one acres of land with 1600 feet of front on the Hudson River, have been secured, and a canal excavated along side of a Brick ware house 420 feet by 90 feet, with other commodious buildings, and wood sheds. Thus in order to manage with economy the business that will naturally be drawn to this important avenue from the grain and provisions districts of this state, to manufacturing New England and her web of railways.

The results, the first year, after the completion of the Western road to Albany, speaks much for this work. With a deficient *motive power*, in proportion to the business offered,—also with 15 miles of the Hudson and Berkshire railroad, an inferior road, and expensive to operate, until their road was completed, the following receipts must cause surprise even to its friends. It is an earnest of the business "the directors look forward to this year" *on the opening of our Canal.*

They have received for 18,570 *through*, and 271,866 *way* PASSENGERS (the receipts from the way being nearly as on 1½ to 1, or $173,566 way, to $92,850 through) the sum of $266,446.

There were 6,211,971 tons *nett*, transported one mile, equal to 39,820 tons carried over the whole road, 156 miles, or, equal to 1026, through trips with 38¾ tons per trip, this amount is about half the capacity of the freight engines, over grades of 83 feet.

There were sent from the Greenbush station, Eastward 170,615.

Barrels of flour, weighing	18,341 Tons		
Beef, Pork, Butter Cheese etc.	12,347 "		
Tons	30,688 "		
Tonnage from Boston and other places going West	9,132	producing	$246,242
Total freight and passengers,			$512,688

The expenses of this business (which includes $48,992 for repairs to the road, and to keep the same in permanent condition) is 52 per cent of the receipts, $256,619

This rate is moderate, compared with the commencement of other roads in New England. The Locomotives on this road, have run 397,295 miles at an expense of only 67 cents per mile. This result, with such heavy grades, and with the difficulties they have had to overcome, attendant on a new work, reflects great credit on the Directors and agents, and gives, as they truly say, "great promise for the future."

There is another and striking view, of the amount of receipts over the Western railroad, compared with the receipts of tolls on our Erie and Champlain Canals after their completion.

The comparative cost and receipts of tolls, the first year after, the completion of those works, 450 miles in length with their feeders, is as follows:—

The cost of the Boston and Worcester railroad	44½	miles,		$2,726,102
The Western railroad,	117	"	$5,814,807	
The Albany and West Stockbridge,	38½	"	1,751,984	7,566,791
Boston to Albany,	200	miles, cost		$10,292,893
The cost of the Erie and Champlain Canals	450	miles, was within		$8,000,000

The entire receipts from *Freight* and *Passengers* 1842

over the Bost. Worcester	$175,674	$186,610	
The Western & Albany	$246,242	$266,446	$874,981

The tolls the *first* year, after the completion of the Erie and Champlain Canals, were - - - $566,12

The fourth year, the tolls were $795,056. The expenses for repairs, agents and collectors have averaged about $1000 to 1200 per mile per annum on the New York Canals.

It is understood that Massachusetts has about $22,000,000 invested in railway stock in that State. The railroad investments in Rhode Island, Maine, New Hampshire and Conneticut equal $5,000,000 additional.

It has been represented that Boston owns half of the stock in the line of railways, from her state line to Buffalo, a distance of 364 miles. The cost of this line may be estimated at $20,000 per mile or $7,200,000.—New England therefore has $31,000,000.—judiciously, invested, producing on an average of 6 per cent, per ann. after ample allowances for renewals, steadily improving.

This view is warranted, on examing the result of the average income, for the last six years of the three first constructed railways, radiating from Boston. These roads are too short for economy in their management. They were built in 1832-3-4 a period when labor was very high. They could now be constructed for about half what they then cost.

	Length	Cost	Expenses for 6 years	Receipts for 6 years	Dividends 6 years	Average for 6 years
Boston and Lowell	26	1,834,893	588,127	1,391,196	46 p.c.	7,66
Boston and Providence	41	1,782,000	847,852	1,499,794	42 "	7
Boston and Worcester	44	2,374,547	778,666	1,594,825	41 "	6,85
Miles,	111	5,990440	2,214,645	$4,485,815	Average	7,15

The several railroads from the Hudson to Buffalo in this state, yields from 6 to 12 per cent., with the exception of the Mohawk and Hudson railroad.

The Canals first constructed in New England, have comparatively, all gone into disuse. This will be the case with the latteral Canals, in this state, on the introduction of good railways. The Erie canal from its peculiar location, connecting inland seas, with the Sea Board, on a remarkable throughfare, will be an exception. The policy of enlarging this work, is beginning to be questioned, even in the Western district through which it passes. The *glory* of the undertaking, heretofore carried the Eastern, and Western counties in favor of the project, without due consideration, any correct estimate of its cost, or its use, to cheapen transportation, when completed.

It may reasonably be expected, that the farmers and traders of our own state, who witness the success of Massachusetts, in carrying all classes of *bulky produce*, at from 2 to 5 cents per ton per mile, and Passengers, at from 1 to 2½ cents per mile, will not permit *the state to monopolize transportation*, for only seven months in the year, —thus excluding them from the seaboard market for provisions in the winter,—the best, both at home and abroad. This too, at a period, when for pleasure, and with profit, the farmer can attend to his own sales, and purchases. If our state restriction on railways to carry freight is taken off, every month in the year, will be a business month.

A smaller capital will enable the merchant and trader, to do a a *safer*, more *certain*, and more profitable business, than formerly.

The system of railways, marked out from New Orleans to Portland in Maine, and the actual completion of a continuous line of 640 miles of road from Portland, to Buffalo on Lake Erie, will when extended, through Ohio to St. Louis, prove the best regulator of domestic exchanges. Railroads are destined to equalize the value of the currency, at all points of the Union. As a means of defence, they require the fostering care of the War Department, and patronage of the Post Office department.

In closing these remarks, which I have been obliged to run off hastily for this number of your Journal, it is proper I should mention, that since the last report, the Boston and Lowell, and Lowell and Nashua railroads, have been extended to Concord in New Hampshire. The Berkeshire railroad, 21 miles from the Housatonic railroad, at the Massachusetts South line, has been completed to Stockbridge, and *put in operation*, for the moderate sum of $205,000. The Eastern railroad, has been continued from Portsmouth to Portland, during the last year, while the construction of the line in Connecticut from Hartford to Springfield, 25 miles, has been secured, thus proving that the march of the railway cause, in *calculating New England*, where the extra sagacity of the people is proverbial, is onward.

The fate of the Farmington, the Blackstone and the Middlesex canals, should be a beacon to deter us in this state, from the construction of any more latteral canals. We should profit by the eloquent, and true passage, taken from a report to the Legislature of Massachusetts in 1839, made by a select committee, when having under consideration, aid to the Western railroad.

The report states, "Railways have universally created the means of their own sustenance, and have drawn to their tracks, employment for their motion. If the beneficence of Providence, had hollowed a channel from Boston to the Western Lakes, and poured the floods of those inland seas, eastward to the Ocean, the blessings would have been too great for sufficient gratitude, as they would have been beyond all computation. The river, swelled by tributary streams, from every valley, would have scattered wealth along its course. For all practical purposes, the invention of art, bestows better advantages, and furnishes communication made more easy and certain, than the bounty of nature could give. During the stern winter of our climate, the rivers are closed one third of the year with ice, in summer they are exhausted for nearly an equal period; their navigation is bounded by the hills that supply their fountains. The railway is neither locked by cold, nor dried up by heat, nor confined by ridges,—streching out its arms to every town and village, it may be extended beyond the highland barriers of water passage, and beyond the Lakes, until its iron bands clasp together in a net work of improvement, overspreading the whole Union."

Very Respectfully,

JOSEPH E. BLOOMFIELD.

TABLE

Of the Cost, Receipts, Expenses, Income, and Dividends of the Railroads in Massachusetts, compiled from the Annual Reports to the Legislature, of January, 1843, made by the several Corporations, under oath. Also, a Comparative View of the Dividends, Expenses, and Receipts of the Boston and Lowell, the Boston and Providence, and the Boston and Worcester Railroads, for the years 1837, 1838, 1839, 1840, 1841, and 1842, inclusive; and of the Nashua and Lowell, and Taunton Railroads, for four years. Prepared, by request, for the "Railroad Journal," by JOSEPH E. BLOOMFIELD.

NAME OF ROAD.	Date.	Length.	Expended in cost of road.	Rep'rs of engines and cars.	Rep'rs of road.	Rep'rs en'gs & cars per mile.	Rep'rs of road per mile.	Fuel, oil, salaries, and incidental expens's.	Total expenses.	Total receipts.	Income from passengers.	Income from freight and the mail.	Dividends per ann.	Miles run.	Cost per mile run ex. of interest on capital.	Maximum grade.	
Boston and Maine	1842	58	1,260 285	8,169	8,693	141	150	35,099	79,278	155,880	109,681	46,199	6	152,454	52 cts.		
Boston and Lowell	1837			16,633	14,056	650	546	33,424	78,508	180,770	117,643	63,137	7				
do do	1838			10,945	15,734	421	611	48,917	75,597	191,780	109,083	82,697	7				
do do	1839			16,384	18,843	636	731	56,923	92,151	241,220	135,037	106,131	8				
do do	1840			14,455	21,013	561	816	55,932	91,400	231,575	127,008	104,567	8				
do do	1841			22,644	33,193	870	1,200	63,631	119,469	267,541	145,953	121,588	8	125,300	81 1-4	10	Double track.
do do	1842	25 3/4	1,978,286	28,816	34,972	1119	1,350	67,223	131,012	278,310	148,042	130,269	8	143,607	83 cts.		
Boston and Providence	1837			29,794	11,707	726	285	114,737	156,238	260,882	193,469	67,413	8				
do do	1838			19,953	16,856	486	411	83,234	120,044	265,114	196,974	68,140	8				
do do	1839			19,467	8,604	474	209	65,491	193,562	313,907	234,237	79,670	8				
do do	1840			16,765	13,281	409	334	78,413	143,127	202,601	134,651	67,949	7				
do do	1841			12,722	24,474	309	597	84,857	122,057	230,821	152,015	78,806	7	107,638	93 cts.	37 1-2	Double in part.
do do	1842	41	1,892,831	135,06	21,082	330	514	78,236	112,824	236,469	163,788	72,686	6	132,229	85 1-3		
Boston and Worcester	1837			20,053	9,185	450	206	65,524	94,762	210,047	123,331	86,716	7 1-2				
do do	1838			15,672	12,521	359	281	42,534	85,572	212,324	112,032	100,292	7 1-2				
do do	1839			25,198	18,035	564	405	83,151	126,384	231,807	122,496	109,311	6				
do do	1840			16,667	40,731	374	830	83,043	140,441	267,547	170,855	96,692	6				
do do	1841			27,584	34,949	620	784	100,514	162,998	310,807	190,097	110,001	7	175,000	93 cts.	42	Double in part.
do do	1842	44 1/2	2,726,102	19,073	41,457	426	903	107,979	168,509	362,293	186,610	175,674	7	241,319	70 "		
Nashua and Lowell	1839			2,273	3,960	156	272	23,663	29,885	55,053	36,647	18,406	6 1-2				
do do	1840			4,736	3,447	332	248	24,763	52,582	82,638	35,794	46,849	7 1-2				

TABLE Continued.

NAME OF ROAD.	Date.	Length.	Expended in cost of road.	Rep'rs of engines and cars.	Rep'rs of road.	Rep'rs en'gs & cars per mile.	Rep'rs of road per mile.	Fuel, oil, saleries and incidental expens's.	Total expenses.	Total receipts.	Income from passengers.	Income from freight and the mail.	Dividends per ann.	Miles run.	Cost per mile run ex. of interest on capital.	Maximum grade.	
Nashua and Lowell	1841			8,263	3,149	589	225	84,563	95,966	132,496	75,732	56,764	8			10	Double track.
do do	1842	14	380,000	7,159	4,339	511	319	32,333	43,825	131,188	66,305	64,883	8	44,040	99½ cts.		
Eastern incomplete	1839			8,563	6,527	214	163	38,048	53,174	125,623	113,068	12,564	5				
do do	1840			12,916	7,909	516	316	64,968	85,793	183,296	164,971	18,326	5				
do do	1841			17,820	31,117	309	520	94,381	154,958	299,574	257,734	41,840	6	191,900	81 "		Single track.
do do	1842	55	2,267,000	14,774	14,786	261	261	89,679	119,039	269,169	237,023	32,145	6	184,127	64 "		
Taunton Branch	1839			3,152	1,397	287	127	36,161	40,711	58,018	40,910	17,108	7				
do do	1840			1,714	2,609	156	237	40,348	44,671	75,477	44,900	30,577	6				
do do	1841			2,253	1,878	205	170	50,912	55,043	76,925	52,279	24,646	7½	20,816	98 "		"
do do	1842	11	250,000	3,419	3,558	220	323	12,088	38,065	77.170	55,711	21,459	8	21,925	133 "		
New Bedford and Taunton	1840			1,318	2,565	120	233	9,162	13,020	26,437	23,250	3,186	6	27,039	82 "		"
do do	1841			3,654	3,416	325	302	15,215	22,285	52,513	39,469	13,044	6	40,734	57 "		
do do	1842	21	426,122	4,418	3,441	210	164	15,496	23,355	55,775	48,483	12,282	6				
Norwich and Worcester	1840								52,503	116,517	78,900	37,617	6				
do do	1841			7,721	6,332	119	108	64,752	78,805	155,261	102,667	52,594	6			22	"
do do	1842	58¼	2,158,562	6,289	10,289	132	161	45,501	62,071	112,347	70,821	41,526					
Western	1840			9,618	6,830	164	117	58,746	75,274	157,358	84,343	79,015		144,881	52 "		
do	1841			16,979	20,207	145	577	67,619	104,806	182,308	113,841	68,467		160,100	65½ "		"
do	1842	117	5,814,807	37,921	48,989	324	418	179,708	266,619	512,688	266,446	246,242		397,295	67 "	83	"
Albany & W. Stockbridge	1842	38½	1,751,084														"
Berkshire	1842	21	205.000														"
Charleston Branch	1842	6	223,144	143	156	24	26	5,890	6,190	12,714	6,168	6,546	3	11,433	54 "	31	"

Notes.—It would appear that the several roads, have generally diminished their expenses proportionate to their receipts, with the exception of the *Boston and Lowell* and the *Boston and Worcester* railroads, both of these roads have taken up parts of the flat rail of 36 lbs., and have substituted a heavy T rail of 56 lbs. The former 20, the latter 12 miles.

The *Boston and Providence* took up 20,329 sleepers and substituted new—the same number will be laid down the next year when the repairs to road it is estimated will not exceed say $12,000 per annum.

The *Lowell and Nashua*, paid $47,744 for the use of the Boston and Lowell railroad,—not included in the above account of expenses of operating the road per mile.

The *Fitchburgh railroad* has just been commenced.

The expense per mile of operating the *Boston and Worcester* railroad, and the *Eastern* railroad, (with an increase of business) has been diminished. The latter carried 468,703 passengers at low fares. A new depot cost $10,081. The total cost of the above thirteen roads to 1 Jan. 1843 is $21,184,123.—The cost of the other roads not enumerated, in Conneticut, Rhode Island, New Hampshire and Maine may safely be estimated, in the absence of returns at $5 to 6,000,000.

Estimated cost of Railroads in New England $27,000,000.

Examination of the Railroad system.

No. IV.

As suplementary to the subject of Financial difficulties we may notice a topic which should properly have been treated in our last article. We refer to

The high price paid for land on our Railroads generally. This is another of those evils attendant upon the times of speculation, coincident with the construction of most of the Railroads in this country. As a general rule we cannot be far from the truth in saying that the prices paid for land were more than double what would now be gladly received by the same individuals for the same property. The sums then charged for Railroad right of way were however always above the current prices for land and were intended to cover the so called *damages* sustained by proprietors, while at the same time that extravagant compensation for unreal damages, was allowed, no offset was permitted to be made for any advantages or benefit to be derived from the road.

A few notorious instances may be given of absurd charges which were made.

When the land taken by one of our main lines of road was appraised, it was given in evidence by one person that if a certain piece of ground of about 30 acres, of which *one* only was taken by the company, were entirely paid for at current prices, and the 29 acres remaining presented to him as a free gift he would not take it. We believe that suggestion of the Chancellor that this was a proper subject for an indictment for perjury was not acted upon.

It is also well known that individuals in very many cases having purchased lands in prospect of improvement by the Railroad have charged for damages as much money as the land originally cost. It is a fact too that persons have purchased on speculation the land through which a projected Railroad was to pass, with the express object of recovering damages.

After reading these and similar instances we need not be surprised to find that no inconsiderable portion of the original cost of many Railroads was expended upon the land alone.

Having thus briefly and in a general manner examined the most remarkable causes which have individually or together operated disadvantageously upon various works, previous to, and during their construction—we have yet a few words to say upon the

Management of Railroads when completed. This is a very extensive field for investigation and might profitably employ the time of any one devoting himself to the subject. Our design at present is merely to notice a few of the more remarkable errors and difficulties attendant upon Railroad management.

The general principles never to be lost sight of are *The maximum of traffic and the minimum of expense.* No saving is profitable that curtails business, and no expenditure is wise, that does not increase it. Railroad companies are not to be regarded as mere monopolies, enriching themselves at the cost of the community—nor as great philanthrophies impoverishing themselves to benefit the public—but

public accommodation and the profit of the company are alike to be regarded.

When Railroads were first used the accommodation afforded, when compared with other modes of conveyance, was certainly but small. Passengers were obliged to repair to certain determined points, few in number, by means of other conveyances—here stage coaches had the advantage—while steamboats sharing in the same disadvantages afforded on the other hand, great room for travellers and a large number of locomotive comforts. But this was soon understood and remedied and now no one mode of travel combines so many advantages and comforts as are attainable by the Railroad system. Similar observations are applicable to the transportation of goods.

But while all this is attainable it is not always attained, and to point out a few of the short comings is our present object.

Some time since we took occasion to insist upon the necessity of a proper professional superintendance (Vol. VII p. 282.) The machinery and management of a Railroad can only be entrusted with safety to one who thoroughly understands them, and yet unlike all other comparable works, Railroads are often committed to the care of those who really do not understand the tools they use. The only valid objection ever offered to them, has been the expense of obtaining engineers as superintendants. We have shown this to be an error in the article, referred to above, and at the present time professional superintendance can certainly be obtained as cheaply as any other. But granting for a moment that it cost more, it is easy to show that the apparent saving is more than made up in other ways. The whole machinery and the road itself may be gradually going to decay while the comfortable idea of saving money is entertained by the directors and stockholders—a great consumption of power may be daily and hourly taking place—that a little real knowledge would at once detect—in short there are a thousand ways of wasting time, power and money, that none but an engineer could discover—and consequently there are as many opportunities of saving by the exercise of a little professional skill. We believe, however, that our doctrine on this subject is coming daily into more favor—certainly the contrast between roads managed and mismanaged is strikingly evident and the best argument in our side.

The want of a properly organized *police* as it is styled in England is another faithful cause of expense and accident. The great length of road in this country is one cause of the insufficiency of force—but it is not so much the number as the regulation of this force to which we refer. If an accident occurs are the men employed so instructed as to their duties as to be strictly *automatic* that is, does each man in his place know what he is to do—to whom he is to give orders and from whom he is to receive them? Or even are the arrangements and instructions sufficient to prevent accident? We think in many cases a negative answer must be given to both these question. Upon our main lines however great

improvements have been made and are still making—and the great demi-god of our country public opinion has done something, not by pointing out how abuses may be corrected—for that it cannot do (notwithstanding Civil Engineering though it does understand almost every thing) but simply by showing that abuses do exist and leaving it to the good sense of the directors to devise the means of correcting them. The locomotive should be the type for all inferior agents on the Railroad—never leaving the track—always going when started—stopping when checked and ever in full career subject to the power of the brake—or even reversing the motion when required—finally silent when not active. There is but one departure from the analogy they must be civil—get out of the way of others, and not like the locomotive make others get out of their way.

At first high prices were thought to be necessary as a renumeration for the great outlay upon Railroads. This notion is now almost universally discarded, either from the good sense or dearly bought experience of directors. So much improvement in this respect has been made and we have said so much upon the subject of low fares that the subject may be dismissed without further notice, with but one remark. When different classes of cars are maintained the highest class should never be above the means of a large number of travellers, or otherwise an empty car or cars will be the result, and ill will towards the company into the bargain—at the same time all classes should be comfortable, decent and clean. The usages of our country and the good sense of managers will soon bring these things to the proper order.

Punctuality is the cardinal virtue upon Railroads. No expense is extravagant that maintains it, and no line will flourish that does not faithfully observe it.

Finally the comfort and convenience of passengers is to be procured in every possible manner. With them a Railroad defies all competition; without them, every other mode of conveyance will be preferred. The details upon this point are so numerous as to prevent even a notice in a single article. We give below extracts from Lieut. Lecount's Treaties on Railways, which we particularly commend for the spirit in which they are written.

Several of the improvements there suggested have been introduced into this country, others of a similar nature have originated here, but there is room for the more general adoption of such comforts.

We have throughout this subject rather spoken of what ought to be than what has not been. It is sufficient to observe that inattention to these points has been a source of loss to many companies—but as we have already remarked, experience is rapidly suggesting improvement which we hope before long to see carried to an extent which will prove beneficial to the public and profitable to the Railroad Companies.

"Directors of railways out of very large towns, should always bear in mind, that those upon which the public find most accommo-

dation and attention to their wants, will, in the long run, carry away all the pleasure traffic; and there are many things yet requisite in this respect. We may instance the regulations (April 1838) for the London and Birmingham railway, that no person can come into the station to see their friends off by the train. This is positively inhuman, and by what process such an insult to the public can have been allowed to come into operation, we know not. Infancy and age, sickness and imbecility, are alike disregarded; and any one who wishes to see husband or wife, child or friend, to the moment of their departure, has no means of doing so but by taking a ticket to the next station on the line. When a thing is so palpable a monopoly as a railway will in general be, and as that railway in particular is, care should be taken not to show it. On the same railway the charge for dogs is monstrous, namely, ten shillings, which has been exacted even for a lady's lap-dog, carried in a muff. Such regulations as these will drive all those from the railway who are not obliged to travel on absolute business; and with an expenditure of five or six millions, (and another line now in the course of construction will most probably exceed the highest of these sums,) every thing that can be done to procure traffic will be necessary, instead of throwing it away. Dogs are not so often required to be carried, and when they are, should be taken at a reasonable rate, and in proper boxes made for the purpose, not locked up under the seats of the second-class carriages, at the risk of being stifled; and when the owner goes at the same time, no charge whatever should be made.

"If a reasonable time for refreshments cannot be allowed, and if the necessary viands for breakfast and luncheon are not provided at the stations, a refreshment carriage should be fitted up for those who choose to take any, which might very simply be done with a stage in sliding parts to lead to it, or the carriages might be made high enough to walk in, and have a communication from one end to the other of the train, as is done on some of the American railways, the passengers sitting along the sides. This would enable every accommodation to be afforded, including portable water-closets. These American carriages are often 60 feet in length, supported by friction rollers on two four-wheeled trucks, to which they are fixed by central pivots, allowing the wheels to accommodate themselves to the curves; and they are also well warmed with stoves. A smoking carriage might also be fitted up, as this habit has become almost a necessary of life with many people; it should be placed last in the train, except horse boxes and empty private carriages, and no platform should communicate with it, nor any connexion exist with the other carriages."

"What we look to in recommending these accommodations is, the number of persons who would take advantage of them, purely for recreation; and we are convinced that no inconsiderable sum of money would be tured into the cashier's hands at the year's end. Many other conveniences might also be contrived on a similar plan. Carriages might also be reserved entirely for ladies, which would

form no inconsiderable accommodation in many instances; also, for outstations, a first, second, and third-class coach may be made in one carriage. Sick carriages would be another great convenience. These might be fitted up in compartments holding two persons each, that is to say, the invalid and his attendant, with a communication to a compartment containing a portable self-acting water-closet. How many persons under the affliction of severe illness would gladly pay double and triple the usual fares for such accommodations as these, whilst the cost to the railway company would be trifling in the first outlay, and amply repaid again with grateful thanks?

"By the use of the sliding stage along the carriages, and still better, by the before described arrangements in America, all the passengers might be accommodated with access to an apartment containing a portable water-closet, the gentlemen being on the one side and the ladies on the other, and a certain sum being paid for the accommodation, say sixpence, on the fare of each person. No complaint could ever be made of this small charge, and it would amply repay the outlay. Having a means of communication from one carriage to another, is a great desideratum in many respects; and as it is perfectly practicable, it is to be hoped that the march of improvement will not cease till it is obtained. In road travelling, a passenger suddenly taken ill, or from any other cause, has nothing to do but to put his head out of the coach window and make his wants known; the coach can be stopped, and he can receive the necessary assistance. But how different is the case in railway travelling? There, unless he has by accident a seat just under the guard, he might exert his voice in vain, and could by no possibility receive the least help if he was dying; in fact, the more he wanted it, the less able would he be to endeavor to obtain it."

"It may be thought that the number of travelling invalids would be so few as hardly to pay the expense of such carriages as these. Setting aside the want of humanity in such an argument, the public have a right to demand some kind of accommodation in this respect, railways having driven from the roads those long established conveyances in which the passengers could be allowed to stop and administer to the wants of nature when imperative, and replaced them by another system, which, great as are its advantages, is certainly in this instance a deprivation, and liable to be a cause of much bodily suffering. Besides, it is not the number of invalids who are obliged to travel, but the number who would travel, both for business, health, and pleasure, if they could have the means of doing so with safety and convenience. How many would be happy to avail themselves of such a mode of conveyance, at almost any price; whilst for the poorer sort of passengers a cheaper carriage might be constructed, which would answer the desired end at very little more expense than the usual second-class coach."

"As nothing which can minister to the comfort and convenience of the public, ought to be neglected, in the organization of a railway, not only as a payment due from these monopolies to the

community at large, but as the readiest means of their producing a remunerating profit on the enormous outlay which is required for their construction in this country, means should be provided at each terminus where the passengers would be able to obtain every accommodation. In the usual course of things, the termini will generally be at some little distance from the towns, in consequence of the additional expense which would be incurred in the purchase of land, if they were taken to a more central situation. From the continual concourse of people at these termini, new buildings will gradually begin to thicken in that part of the town, and, in a few years, habitations will begin to embrace the railway station on all sides. Inns and shops will be amongst the earliest of these erections; still this will be a work of time, and will little accord with the impulse given to the mind by railway travelling."

"It will therefore be highly advantageous, both to the proprietors of the railways and to the public, if the directors provide for the accommodation of the passengers, simultaneously with the opening of their railway. The expense will be small, and the profit may, with the utmost certainty, be reckoned on as equal to that of any other portion of their property. A building should therefore be erected on a convenient spot, adjacent to the principal stations, which should afford to each class of passengers the means of obtaining refreshments in that manner to which their habits and station in life have accustomed them. Such buildings would admit of considerable architectural display, and, if it should not in any case be thought advisable to include their cost in the general outlay, they may be a separate jointstock speculation, the shares being offered, in the first instance, to the proprietors of the railway shares as was done by the London and Birmingham railway company."

The January number of the Civil Engineer and Architects Journal contains the following letter from a New York correspondent with remarks by the Editor. We give the whole as representing in a fair manner some of the main points at issue between English and American Engineers—and also, as conveying, considering the circumstances, a very handsome compliment to our fellow townsmen Messrs. Stillman & Co.

It does not require any assertion of our own that to convince American Engineers, that the engines of the S. & Co. display more originality and real improvement than the English marine engines which we have had an opportunity of examining in our own waters—for these latter are generally speaking strikingly devoid of any exortifications of the old places.

American Marine Steam Engines.

Sir—A late number of your *Journal* contained some remarks concerning American Marine Steam Engines, which were in a spirit very unlike the usual tone of the English press in descanting upon "Brother Jonathan's" available genius in such matters. Candid, fair, impartial criticism, no matter how close it may chance to "cut," will do much towards removing

those mutual prejudices which unhappily exist to such an extent, that the mere imprint of "American or "English," is oftentimes of itself sufficient to place the merits of any work without the pale of respectful controversy.

This should not be; there is not the least of necessity or of policy in being thus deprived of the benefits of each other's experience; as advantages in some shape or other, most undoubtedly belong to each, and only require to be known in order to be secured. As an illustration, might be adduced the acquaintance already formed through the establishment of your Transatlantic Steam Navigation Companies. One or two instances will suffice. In the English marine engine we see a connecting rod 15 feet long, and 10¼ inches diameter, subjected to the same direct stress with the connecting rod of the American engine, and which is 24 feet long and 6 inches diameter; two thirds *less in area*, and one third *greater in length*, and yet performing equally well the same labor! By this, we are taught, that while the English engines are certainly at *one extreme*, we are probably at the other. Again; the *Great Western*, if you please, comes over here with decks as "clean" as a "man of war," and returns with the singular notion, that on her quarter deck, can be erected, at a trifling expense, a saloon equal in every respect—and superior in many—to the one below, and making an addition to her accommodations equal to one third of all her cabin room below deck!

Notwithstanding the unequalled degree of perfection to which steam navigation upon our rivers has attained—excepting, of course, the great river of the west—the impression is very prevalent abroad, that in the attempt to compete with the "Lion of the seas," we shall be found wanting—an impression unfortunately, most consistent with a certain illegitimate specimen of "Yankee enterprise," which has recently visited your shores. We think however, that the time is not far distant when, with a ship exceeding in length the ordinary proportion, with engines having greater length of stroke so as to admit of working steam at a greater pressure without adding weight to the working parts, with paddle wheels large in diameter, very narrow and making revolutions not less than 20 per minute; and with boilers adapted to a pressure of 15lb., to 20lb., we shall be able somewhat to "shorten the distance" which separates us from the "land of our fathers." Certain it is, that our ship-builders and engineers will not be satisfied with a steamer which will require, for a passage to Liverpool, more than *ten days* of good weather.

You were pleased to notice in a favorable manner the engines of the Spanish steamers *Regent* and *Congress*, built by the late firm of Ward, Stillman & Co., of the Novelty iron works, New York, and to intimate a wish to have the details of their arrangement. In answer to which, I take pleasure in sending to you a detailed account of those vessels, together with so much of a drawing of their engines, as will answer the purpose of your inquiry, and which I am authorized to do by Messrs. Stillman & Co.

Vessels:—	Feet	Inches.
Length on deck	154	0
Breadth	30	8
Ditto at water line	28	8
Depth of hold	14	6
Draft of water	8	6
Burthen	671 tons.	

Frame of white oak, live oak, locust and cedar. The floor of white oak laid close and caulked inside and out. Planked with white oak; fastened

throughout with copper thorough bolts, composition spikes and locust tree-nails.

Engines:—
Diameter of cylinders 42½ inches.
Length of stroke 4 feet 7 inches.
Diameter of paddle wheels 18 feet.
Length of board 7 feet 6 inches, and width 2 feet 6 inches.
Pressure of steam 10lb.
Number of revolutions per minute 26.
Total weight of engines; wheels and boilers 100 tons.
Two copper boilers 22 tons.
Length of boilers 14 feet, height 9 feet, and breadth 8 feet.
Total of fire surface 1400 feet.
Speed of vessel 10 miles per hour.
Cost of vessel, engines and boilers, about 150,000 dollars.

It would be trifling, I fear, with the patience of your readers, to enter into a detailed description of the drawings, representing, as they do—with one or two exceptions—but an "old acquaintance," the "side lever engine;" the principal deviation from which, is the steam valves, and perhaps the air-pump bucket. The valves are shown in the section in the same position as in the drawings you refer to as having received, and which has recently been published in the London *Mechanics' Magazine*. As to the merit of this arrangement of the valves I will not now offer an opinion, except that they are not generally used here for large engines.

As English engineers—either from strict fidelity to the *opinions of Watt* or from much actual *experience*—have held us guilty of divers "barbarisms," in our substitutions for the use of the "slide valve," I shall make this matter the subject of another communication, accompanied with a sketch of the most approved form of the "double" or "balance valve."

The bucket of the air-pump, as shown in the separate sketch, for aught I know, may not be peculiar to this country, nor is it universally adopted here; it has been found, however—in situations where the condensing water is free from sand—to be far more efficient and durable than any other in use.

The "bilge injection," shown near the bottom of the condenser, is here thought to be an essential part of the engine of every steam vessel. And instances have occurred in which the use of it has been attended with the saving of much life and property.

With your permission, I will from time to time furnish your readers with notices—accompanied with drawings—of such improvements in American engineering, as may be thought interesting, or of such of its features as are not familiar to our transatlantic brethren generally.

I am, Sir, &c.,

New York, July 1842. F. W. S.

In our Journal for June last, we noticed that the Spanish government had ordered, and obtained from New York two war steamers, named the "Regent" and "Congress," and in commenting thereon we observed, we wished some further information before we give any opinion on the subject; we were favored with a lithographed external view of the engines, but we desired to look below the surface. Our wish has now been complied with, we are in possession of an apparently perfect section of the engines of the *Regent* and *Congress* steam ships, together with F. W. S's. remarks thereon. and which we now publish. We thank him, and think, if his intentions are supported by engineers of the Old and New World, it

will do much towards the explosion of prejudice, the extension of knowledge, and general good of mankind; that we heartily co-operate in this view we plainly avow, as in fact our remarks in our last December number fully prove. We are, therefore, surprised at the opening paragraph of our correspondent, and we are unconscious of having admitted any thing into our columns which could offend his taste. If we have descanted upon "Brother Jonathan," it was more in playfulness than anger, not as an opposing race, but as descendants of one common stock, to which *genius* is common. We think, however, our correspondent's reprehensions are misapplied, as we do not recollect using the phrase *he* complains of. With this exordium we at once proceed to an analysis and consideration of the engines of the *Regent* and *Congress*.

The engines are of the *beam* kind, and scarcely to be distinguished from those of the *Megera* by Seaward, published by Weale in his Tredgold, pl. 49, vol. 2. The *architecture* is very similar to the engines of the *Tiger*. by Edward Bury. (See Tredgold, vol. 2, plates 110 and 110 a. In one point they differ, in the use of circular valves instead of the D or Murdock slide, and in this it resembles another emanation of American intellect, calledthe *Royal William* (now *Isabella II.*) which made the voyage to England in 1832, and subsequently figured in the Spanish war.

The cylinders are 42½ inches diameter and 4 ft, 7 in. stroke; at 26 strokes or 238 feet the power is equal to 71½ horses each, or 143 horses collectively. This is nominal power as calculated by the rules of the late Mr. Watt, applicable to steam of 2½ or 3 lb. per inch, but in this case we have a pressure on the safety valve of 10 lb. per square inch, so that the *actual* power will probably be 150 per cent. above this, depending entirely upon the expansion used, and we may further observe, that with a suitable arrangement, circular valves may be made to produce any degree of expansion, at pleasure. The air pump is 22 inches diameter, and about 2 ft. 6 in. stroke, = a content of 6·6 cubic feet. Cylinder 42½ in. + 4 ft. 7 in. long = 49·46 feet content, which divided by 6·6, makes the cylinder 7·5 times larger than the pump, just the usual proportions of English engines. The condenser is 2 ft. 5 in. fore and aft, 3 ft. 5 in. in width, and 4 ft. high, with proper deductions is equal to a content of 24 cubic feet, and 71·5 ÷ 24 = nearly 3 cubic per H. P. The circular steam valves are 11½ in. diameter = 103·86 area, the eduction valves are 10 in. diameter = 78·54 area, or rather more than a square inch per horse, a very ample allowance, and much exceeding Mr. Watt's rules, as will be seen by reference to Farey and other works, but taking into consideration the increased density of the steam employed, is judicious. and about on a par with modern *slide* valve practice. Our correspondent is wrong in supposing that English engineers have adhered to the slide valve "from strict fidelity to the opinions of Watt." It is otherwise; they have departed therefrom and followed Murdock, his disciple, who patented the D, triangular, or other shaped sliding valve, in his specification of 1790 (See Farey, p. 677.) We are at a loss, also, to find any novelty in the construction of the circular valves; they appear to us precisely similar to those used by Mr. Watt* in his engines of 1808. He used circular pipes, and here we have rectangular passages (See Farey, plate 20.) We are equally obtuse respecting the air pump, of which we have an isometrical drawing, and can find nothing new therein; if our correspondent alludes to the packing ring similar to that of the piston, we may say that system has been followed in this coun-

* Or rather his successors Boulton and Watt. Mr. Watt retired from business in 1800.

since the year 1826, perhaps earlier. The bilge injection is in the same category.

There is merit in the adaptation of a double beat expansion valve, though it is by no means new and we think we can suggest an improvement as the lower face can never be tight. The other parts of these engines are so much like the best English practice, that it is needless to pursue the inquiry farther. The space occupied in the vessel for each engine is 16 ft. fore and aft, and about 5 ft. 9 in. over the main beams.

On the whole, we think the engines of the *Regent* and *Congress* to be highly creditable to Messrs. Ward, Stillman & Co. of New York, by whom they were manufactured. not only as evincing considerable judgment in detail, but more so, in their selection of the common beam engine, which, after all, appears to be the best kind yet produced.

Extract from Address

Delivered at the close of the Twelfth Exhibition of American Manufactures, held by the Franklin Institute of the State of Pennsylvania, for the Promotion of the Mechanic Arts, October, 1842; by A. D. Bache, *LL. D., Prof. of Nat. Philos. and Chem. University of Pennsylvania.*

CONTINUED FROM PAGE 32.

What have *we* done to advance the progress of the useful arts? First, what have been the results of our exhibitions? The same which experience all the world over has shown to result from them. But will it be said by any one, however enthusiastic, that the contrast between the meagre show in the Carpenter's Hall, at our first exhibition, in 1824, and the brilliant display which is just now terminated, is due to these exhibitions, or to those in Philadelphia, New York and Boston, combined? Let us reply by another question. Would we, or would we not, have arrived at the same point without these annual or biennial shows? I answer unhesitatingly, No! It has been remarked of exhibitions of specimens in the arts elsewhere, that though the same artists produce the specimens, there is a steady improvement in them. The taste of the public is improved by them—the taste of the artist is elevated. So, here, observe from year to year the growth in taste of the judges of the different articles submitted at the exhibition, and of the depositors, who are the venders of the manufactured articles. What a powerful reaction must be produced by thus furnishing the vender with the means of accurate comparison, the conclusions from which he may communicate to the manufacturer. Observe the public generally, how the admired articles of one year are the rejected of the next! Listen to the remarks made upon those branches of industry which are stationary. To deal with history instead of what is present; turn to the exhibition of two years ago. Take a branch of manufacture then dead, and compare the effect produced by the well preserved mummies of specimens, though carefully washed and well placed for show, with the results of their first living appear-

ance. The glazing and gilding are untouched, the colors of the painting are as bright as ever, the designs just as tasteful as they were when first exhibited; but the taste of the public is improved the specimens are returned to their cases, their interest for the future is purely historical—they are deposited among the archives of the arts. The influence of this improvement in public taste alone is not to be rejected.

It is obvious, then, that there are reasons why exhibitions should contribute to *aid* that which requires other causes to support. If they neither form the foundation of the building, nor yet its superstructure, they serve to determine its shape and the arrangement and distribution of its parts.

The influence of the medals and certificates awarded at these exhibitions is much undervalued by many, who, looking merely at their intrinsic value, consider them as so much silver or paper, They would value in the same way expressions of esteem as so much breath. The great dramatist has sufficiently held such persons up to ridicule by putting their argument touching honor in the mouth of that impersonation of all that is ludicrously contemptible —Falstaff. These testimonials have, however, a value in dollars and cents, which, though *I* cannot precisely estimate it, others may. Those who know enough to be aware of their own ignorance, look to others who have knowledge to guide their opinions. Thus the opinions of the judges, expressed at the exhibitions, become the guides of many and many purchasers, who seek or reject, not according to their own judgments, but according to the decisions of the Institute. Rely upon it, these exhibitions and the premiums awarded at them, have a powerful action upon the consumer, the vender, and the manufacturer, and through them upon the arts.

These periodical exhibitions are times of high excitement in the Franklin Institute. The public is called in, and the members are their entertainers. The fly-wheel of the institution appears to have been thrown out of gear, and the motion is rapidly accelerated. It could not exist under a long continued action of this sort. Why should not provision be made in the ordinary and regular working of the Institution for a constant exhibition? Why should all these products once collected be dispersed, never again to be re-united? Like the Conservatory of Arts, of Paris, or the Trade Institute, of Berlin, we should find such a collection a chronicle of the history of each art in our country. As in the Polytechnic Institute of Vienna, we should find by the side of models and machinery, the raw materials and products of our manufacturers and arts, from the date of their introduction, or use, to the day of exhibition. Were our *Sovereign* prepared to erect the piles of the Conservatory or of the Polytechnic school, we should easily find articles to fill their ample halls,—and is it impossible that this should ever be? Look at the structures raised by the public for education. Who would have believed forty years ago, that such would now exist by the means which have raised them? Voluntary association may do much, but not everything. The desire to accomplish this, among

other purposes, led to the attempt to extend the accommodations of the Institute in 1835. Perhaps under other circumstances we might have succeeded. Had the tide continued to rise, instead of beginning to fall, we might have passed the shoal, and found ourselves in smooth water on the inner side. We may now be satisfied that having ventured much for a great good, we are still safe. This branch of our Institute must bide its time. Meanwhile, the exertions of the Professors and members are forming the nucleus of cabinets of models and products of the arts, which promise to become of value; and the steps taken by the Managers to obtain from depositors specimens of those articles which take premiums or certificates, where the nature of them admits of it, will, if met in the spirit of liberality by the contributors, soon secure a useful and large collection. How interesting a view would have been presented of the progress of American arts, had such specimens been collected at all our Exhibitions! And while on this theme, does not memory call before us one dear to the Institute, as among its earliest friends, its founders, its first Professor of Chemistry, who made the earliest beginning of our cabinet of arts and manufactures, whose zeal and judgment connected him with our best and most useful efforts—though removed from us by death, he lives in our affections, and his name will be perpetuated in the history of our Institution. We already begin to have a history. Already the obelisk is raised, upon the base of which the names of the useful, zealous, and able, among the members of the Franklin Institute are to be inscribed at death—that tablet bears even now the names of Keating and of Ronaldson.

The awarding of premiums for inventions, though distinctly different in part of its operation from similar awards for the best specimen of any art, owes its efficacy to the same principles. It is not the value of the prize, but the value of the opinion, which causes the inventor to submit his designs for examination. This consideration of inventions forms part of the every day business of the Institute. Formerly it was done by the Committee on Inventions, and now by the Committee on Science and the Arts, formed by the voluntary association of the members of the Institute. The time and capital which have been saved to projectors, and to those who furnish them with means, through this Committee, are not the least important of its results. Men who were flattered at home with the idea of being Fultons and Watts, have found that, after all, Fultonism is not so easy of attainment, and those who were prepared to embark their means in schemes, have been saved both money and chagrin. Our countrymen are yet favored, occasionally, with the *novel and astounding* sight of vessels torn to pieces by the destructive agency of gunpowder, fired by the also *novel* method of a wire, heated by means of a distant galvanic battery—and all at the expense of the United States. With the explosion of unexplodable boilers, or of some old fashioned way of preventing this catastrophe. These things merely indicate, perhaps, a plethora in the National Treasury, or, perhaps, that all knowledge is not

given instanter, upon being elected even to high political stations. But, seriously, the award of the Scott's legacy medal and premiums, which our City Councils have delegated to the Franklin Institute, is the source of much usefulness, and, coupled with the opinions given by the practical and scientific men who are united in the Committee of Science and the Arts, has worked good to the arts, their cultivators, and their patrons.

In nearly all the institutions abroad to which I have referred, the publication of a journal in which to record inventions and improvements in the arts, and discoveries in the sciences which bear upon them, is regarded as of high importance. It is obvious, indeed, that this is the only effectual mode of diffusing a knowledge of improvement over a wide space. In days gone by, the mechanic of Continental Europe passed part of his appreticeship in wandering from place to place, to practice his art, as a means of support, and gathering the improvements which might have been made in it, to turn to account on his return home. Now the Journal brings to his door the improvements of the most distant places, with all the rapidity which steam navigation and railroad transit can give. There can be no doubt that of all the means of usefulness of the Franklin Institute, the publication of its monthly Journal is most widely operative. Its readers find a chronicle of the ingenuity of our country in the patents recorded in its pages, while they find the wheat separated to their hand from the chaff, winnowed by the labors of one who brings knowledge unsurpassed in this department to the execution of his work. Copious extracts from foreign journals convey the improvements of Europe to our mechanics and manufacturers, while original articles from our own mechanics, engineers, and men of science, contribute their full quota to the interest and usefulness of the work. It was early determined by the Institute that such a journal must be maintained, and the present periodical, originally commenced by the Professor of Mechanics, was adopted. The expensive nature of the work, its low price and the limited support which it was likely for many years to receive, forbade the idea that it would be a money-making undertaking; and the Institute has been satisfied to support it, as a means of usefulness, at a small annual loss in money. But, for a feature characteristic of the enterprizes of the Franklin Institute, there can be no doubt that this undertaking would have been onerous. Whenever a line of labor likely to benefit the public has been pointed out, and a scheme for rendering it available has been well matured, members have been always found willing to devote their time to its successful execution. It is thus that men engaged in laborious occupations, in which their time and talents are money, have devoted themselves, day after day, to labors enjoyed by the Institution, without looking for any other reward than that of being useful. It is thus that the pages of our Jornal are supplied with materials, original and selected, (some requiring the labor of translation from foreign languages,) by the generous labors of collaborators, whose zeal is tried by the monthly repetition of its exercise.

With all these resources at command, the Institute is still obliged to look to the benefit of this work to the mechanic, as a motive to support its expense, and to wait, in this as in some other enterprises, the time when a greater intelligence in our country at large and increasing resources, will fully repay the pecuniary outlay annually made.

One branch of the labors of the members of the Franklin Institute has, I believe, no precedent in any similar institution—I mean that of original investigation and research. The Institution thus aids to advance as well as to diffuse knowledge. Of the experiments of the Committee on Water Power, one of the highest living authorities (Mr. Rennie) has spoken in terms of the highest praise. The results of the experiments on the explosion of steam boilers have contributed strongly to turn attention away from imaginary sources of danger, and to fix them upon real ones. The conclusions from some of the more refined and difficult experiments, are quoted in quarters which cannot be suspected of either local or national partiality. These various researches, together with those on the strength of materials, must ever remain a monument of the industry and zeal of the early members of the Franklin Institute. They furnish a claim to public favor and support that no similar institution can justly put forth.

From these extended schemes, in which the members of the Franklin Institute are only incidentally partakers with the public in the common good effected by their instrumentality, let us turn our attention to the special means of promoting the mechanic arts, through the intellectual cultivation of those who pursue them. In the infancy of science, every experiment led to a discovery, and the art offered a scarcely less fertile field than science to their cultivators. Now discoveries in science and improvement in art, are the result of well directed trains of observation, experiment and thought. To direct these, the arts call in the aid of theoretical science. Besides the general cultivation of mind to be derived from pursuing any branch of knowledge, in the sciences of mechanics and chemistry are to be found those principles which alone are safe guides to improvement. It will, perhaps, hardly be believed, but it is, nevertheless, true, that not ten years since there lived in our city an ingenious man, who wasted his time and substance, and the resources of his family, in a pursuit after the perpetual motion. How many such disastrous results are prevented from year to year, by the application of principles taught in the lecture room, may be inferred from the number which require the additional nipping action of the Committee on Science and the Arts. Besides, the lectures upon mechanics and chemistry, which constitute the frame-work of our system, the filling up of architecture, mineralogy and mining, has been supplied by the voluntary contributions of members distinguished for their knowledge, and for their powers of communicating it; and even kindred branches of natural history have been, from time to time, furnished from similar sources.

It has always been the liberal policy of the Franklin Institute,

while retaining the control of the institution where, from its nature, the control should be retained—in the hands of mechanics—to call in the talents of other professions to their aid. While by the constitution, two-thirds of the Board of Managers must be manufacturers or mechanics, every citizen is free to become a member. No co-operation is spurned; and in return, knowledge, time, and talent, of various kinds, are at the disposal of the foster mother. This same liberal principle of action shows itself in the very moderate requital expected for all the privileges bestowed, by which membership in the Franklin Institute is placed within the means furnished by the deposit of one cent for each of the working days of the year. Exclusiveness is absent from each and every department of the Institute, and to a degree which, to those who believe such establishments are raised and must be used for the benefit of certain cliques, and the propagation of certain individual influences is almost startling. What would be thought of raising a voluntary committee of the members of an institution, the annual contribution to which of three dollars makes a member, to consider important inventions and improvements in the arts. Such a thing, the advocates of cliques would say, must lead to confusion. A voluntary committee is wholly uncontrolable—and so it should be. Just such a committee—just so uncontrolable—has existed and flourished in the Franklin Institute for several years, every member being at liberty to join it who is willing to perform the labor required of him. I do not think I overrate the importance of this association of members, when I place it next to the lectures. The library and reading room are no doubt more extensively useful to the members; but the knowledge acquired from books and experience, which is called into action in such various ways, and on so many occasions, in the Committee on Science, and the opportunities for intellectual culture afforded by calm investigation, by cool, but earnest, discussion, and by the appeal to experiment, are so practically improving as to rank above all passive means of cultivation.

Besides the Lectures, the Library, and the Committee on Science the Monthly Conversation Meetings serve as rallying points—as opportunities of giving instruction or of being instructed in the scientific or mechanical novelties of the day. In a large metropolis like London, it is always possible, during at least a part of the year, to obtain materials for even weekly meetings of this sort. At the Royal Institution of London, there is an informal lecture at least once a week, corresponding somewhat to our Conversation Meeting. If we could concentrate here the novelties which in our country find vent through various channels, we should be able to carry on these meetings with more spirit than is now done. In the meantime, they are often both agreeable and useful, and, doubtless, will be kept up with occasional intervals.

While thus providing for the improvement of its members, the Franklin Institute has not forgotten their families, their wives and daughters, as well as their sons, wards, and apprentices. When the lectures of the Franklin Institute first commenced, ladies were not

in the habit of attending lectures—in other words, custom most ungallantly excluded them from opportunities of intellectual amusement and advantage. The Institute has turned custom out of the doors, and taken the ladies within them.

A series of schools for youth at one time entered into the plan of the institution. Of these, the drawing school alone is still kept up with an efficiency and advantage which command patronage. I have very little doubt that had not public education taken the new position it now occupies in our city, these designs of the Institute would have been extended. The sovereign has now awaked to the advantages of supporting public schools by public means, although not yet fully prepared to push the principles upon which they are based to their utmost limit.

Among all these means of usefulness, there is no School of Commerce and the Arts like the Polytechnic Institution of Vienna, no School of Arts and Trades like the Berlin Institute, no School of Arts and Manufactures like the Paris Institution. The establishment of a School of Arts has been a favorite project with the Franklin Institute, but thus far has scarcely passed beyond a project; at one time on the point of receiving aid from the Commonwealth, at another almost put in operation by individual enterprize. This object requires means, and these we have not at our disposal. Will public opinion ever so far ripen as to furnish these means? This is an interesting inquiry. I have heard it remarked by more than one person conversant with the minutiæ of the institutions of Philadelphia, that all the enterprizes for the diffusion of knowledge are supported by a small portion of our population; and yet they are intended for the ultimate good of *all*, and should be supported by the *whole community*. There was no doubt a time when the idea of paying for the support of a fire department would have seemed preposterous, and now we quietly pay for insuring our houses, and then in addition, a portion of our taxes goes to furnish the means and appliances for extinguishing fires. What would we think now of supporting a fire department entirely by voluntary contributions? So public opinion oscillates from one side to another. What is at one time impossible, at another is firmly established as the general usage. Where shall we draw the line between that which is to be supported by general assessment, and that by particular contribution? *Shall the principle be that, what is for the good of the whole, shall be supported by the whole?*

It has been long established that the poor must be instructed at the public expense. It is found *cheaper* to educate the masses than to pay for the fruits of ignorance. Besides which, christian charity cares for the souls as well as the bodies of men. But the scheme of public education, free to all, is, even now, and in our own country, very imperfectly understood. Indeed it may be doubted if the public are yet prepared fully to follow it to its consequences. We began, in this country, after the example of the old world, to endow institutions for higher education, universities and colleges. Then we found that this was beginning to build the house at the top. We

turned and established schools, common schools, and occasionally a high school. And now the foundation and superstructure have no connexion. Is not this all wrong?

If we want precedent for a different state of things from the old world, we can find it, and so be borne out by experience, as far as institutions trammelled by feudalism can be guides to us. The so-called University of France includes all public institution within its organization; the highest and lowest are free; why not the middle? why not all?

But it may be said we agree that that which shall benefit all shall be supported by all. We agree that education shall be put upon a *truly republican* basis, that all the schools, from the lowest to the highest, shall be supported from the public purse, that a wider range shall be taken than now in education, and yet the whole shall be supported by the public. But you go further, you ask that institutions for the benefit of certain classes, by name merchants, manufacturers and mechanics, shall be supported or subsidized from the public purse. These classes certainly, in my view, make up no small or unimportant portion of our community. They are surely not so few in numbers, nor so insignificant in influence, that their interests may be overlooked.

But I would go beyond this, and include in one wide system all the institutions of every name for the promotion of knowledge. It is not necessary to weigh their relative usefulness. It would be easy to bring up an array which would include all classes of our community. The Mercantile Library has its objects, the Apprentices' Library others; the Philadelphia Library, the Athenæum, the Philosophical Society, the Academy of Natural Sciences, the Philadelphia Museum, the Athenian Institute, and many similar associations each and all have their spheres of usefulness. Take them together do not their objects include in their range the interests of every citizen of Philadelphia? Are they not intended for the benefit of classes which include all? Would not good done to all of them be done to the whole community? If not, let others occupy the vacant ground. Nor would the difficulty of adjusting claims be an insuperable one. For such it never has been in any country where such a plan has been in fact executed, and executed it has been in many, though not perhaps systematised. What, for example, is the support of the Polytechnic School of Vienna, and of its Conservatory, from the public purse, but part of such a scheme? and just such a part as the subsidizing of the Franklin Institute, under its present organization and management, would be. What the establishment of a Museum of Natural History and of Coins and Antiquities, but the support of the Academy of Natural Sciences and the Museum? What the support of a Royal Library but that of the Philadelphia Library? All of these, or nearly all, every where are under different boards of administration. The scheme is not so Utopian as, at first sight, it might appear. Our schools, colleges, universities, institutes, museums, academies, associations, under whatever name, for the diffusion and advancement of knowledge, constitute an as-

semblage of objects, embracing within its scope all classes and all interests. Let me commend to your thoughts the idea of forming *a system* from these various parts, not centralized, but like our own political union, each independent, while all are united, *a great system of public instruction, worthy the patronage and support of a free and enlightened people.*

If public opinion were once right in regard to it, the details of the plan would present no serious obstacles. I have just read that a munificent Englishman has left nearly half a million of dollars to two institutions connected with the University of Oxford. Perhaps liberal individuals among us may one day turn their attention to the beginning of some scheme of general secular instruction, required imperiously in aid of moral and religious culture, by the nature of our political institutions. Without intelligence, virtue is comparatively powerless; without virtue and intelligence, liberty degenerates into licentiousness, independence into brutality. Liberty and independence exist but in name. When virtue, liberty and independence fail, the commonwealth which has chosen them as her watchwords, and has emblazoned them with the emblems of agriculture, commerce and the arts upon her arms, will cease to have a being.

Notice of Experiments regarding the Visibility of Lights in Rapid Motion, made with a view to the Improvement of Lighthouses; and of some peculiarities in the impressions made by them on the Eye. By Alan Stevenson, *LL. B., F. R. S. E., Civil Engineer.*

In experimenting on this subject, I used the apparatus formerly employed by Captain Hall. It consisted of an octagonal frame, which carried eight of the disks that compose the central part of Fresnel's compound lens, and was susceptible of being revolved slowly or quickly, at pleasure, by means of a crank handle and some intermediate gearing. The experiments were nearly identical with those made by Captain Hall, who contrasted the effect of a single lens at rest, or moving very slowly, with that produced by the eight lenses, revolving with such velocity as to cause an apparently continuous impression on the eye. To this experiment I added that of comparing the beam thrown out by the central portion of a cylindric refractor, such as is used at the fixed light of the Isle of May, with the continuous impression obtained by the rapid revolution of the lenses. Captain Hall made all his comparisons at the short distance of one hundred yards, and in order to obtain some measure of the intensity, he viewed the lights through plates of colored glass until the luminous disks became invisible to the eye. I repeated these experiments at Gullan, under similar circumstances, but with very different results. I shall not, however, enter upon the discussion of these differences at present, although they are susceptible of explanation, and are corroborative of the conclusions at which I have arrived, by comparing the lights at a distance of

fourteen miles, but shall proceed to detail the more important results which were obtained by the distant view. Several members of the Royal Society witnessed the results of the experiments, which I shall briefly describe in the following order:

1. The flash of the lens revolving slowly was very much larger than that of the rapidly revolving series; and this decreasing of size in the luminous object presented to the eye, became more marked as the rate of revolution was accelerated, so that at the velocity of eight or ten flashes in a second, the naked eye could hardly detect it, and only a few of the observers saw it: while the steady light from the refractory was distinctly visible.

2. There was also a marked falling off in the brilliancy of the rapid flashes as compared with that of the slow ones; but this effect was by no means so striking as the decrease of volume.

3. Continuity of impression was not attained at the rate of five flashes in a second, but each flash appeared to be distinctly separated by an interval of darkness; and even when the nearest approach to continuity was made, by the recurrence of eight or ten flashes in a second, the light still presented a twinkling appearance, which was well contrasted with the steady and unchanging effect of the cylindric refractor.

4. The light of the cylindric refractor was, as already stated, steady and unchanging, and of much larger volume than the rapidly revolving flashes. It did not, however, appear so brilliant as the flashes of the quickly revolving lenses, more especially at the lower rate of five flashes in a second.

5. When viewed through a telescope, the difference of volume between the light of the cylindric refractor and that produced by the lenses at their greatest velocity, was very striking. The former presented a large diffuse object of inferior brilliancy, while the latter exhibited a sharp pin point of brilliant light.

Upon a careful consideration of these facts, it appears warrantable to draw the following general conclusion:

1. That our expectations as to the effects of light, when distributed according to the law of its natural horizontal divergence, are supported by observed facts as to the visibility of such lights, contrasted with those whose continuity of effect is produced by collecting the whole light into bright pencils, and causing them to revolve with great velocity.

2. It appears that this deficiency of visibility seems to be chiefly due to a want of volume in the luminous object, and also, although in a less degree, to a loss of intensity; both of which defects appear to increase in proportion as the motion of the luminous object is accelerated.

3. That this deficiency of volume is the most remarkable optical phenomenon connected with the rapid motion of luminous bodies, and that it appears to be directly proportional to the velocity of their passage over the eye.

4. That there is reason to suspect that the visibility of distant lights depends on the volume of the impression, in a greater degree than has, perhaps, been generally imagined.

5. That as the size and intensity of the radiants causing these various impressions to a distant observer, are the same, the volume of the light, and, consequently, *cæteris paribus*. its visibility is within certain limits, proportionate to the time during which the object is present to the eye.

Such appear to be the general conclusions which these experiments warrant us in drawing: and the practical result, in so far as lighthouses are concerned, seems sufficient to discourage us from attempting to improve the visibility of fixed lights in the manner proposed by Captain Hall, even supposing the practical difficulties connected with the great centrifugal force generated by the rapid revolution of the lenses, to be less than they really are.

I shall be excused, I hope, for saying a few words in conclusion regarding the decrease in the volume of the luminous object, caused by the rapid motion of the lights. This effect is interesting, from the apparent connexion with the curious phenomenon of irradiation. When luminous bodies, such as the lights of distant lamps, are seen by night, they appear much larger than they would do by day; and this effect is said to be produced by irradiation. M. Plateau, in his elaborate essay on this subject, after a careful examination of all the theories of irradiation, states it to be his opinion that the most probable mode of accounting for the various observed phenomena of irradiation, is to suppose that, in the case of a night view, the excitement caused by light is propagated over the retina beyond the limits of the day image of the object, owing to the increased stimulus produced by the contrast of light and darkness; and he also lays it down as a law, confirmed by numerous experiments, that irradiation increases with the duration of the observation. It appears, therefore, not unreasonable to conjecture, that the deficiency of volume observed during the rapid revolution of the lenses, may have been caused by the light being present to the eye so short a time the retina was not stimulated in a degree sufficient to produce the amount of irradiation required for causing a large visual object. When, indeed, the statement of M. Plateau, that irradiation is proportional to the duration of the observation, is taken, in connexion with the observed fact that the volume of the light decreased as the motion of the lenses was accelerated, it seems almost impossible to avoid connecting together the two phenomena, as cause and effect.—*Edinb. New Philos. Jour.*

Wire Rope.—Mr. A. Smith has read a paper before the Society of Arts, on the manufacture of wire rope for standing rigging etc. The results of experiments made by order of the admiralty, are that standing rigging of wire rope of equal strength with the hempen rope, one third of the size and half the weight, may be fitted at about two thirds the cost. Mr. Smith stated that "the standing rigging now fitted in her majesty's Navy presents a surface of upwards of 600,000 square feet, which is about equal to the surface of the sails of twenty four first class frigates," that "one fathom of hempen rope

about three inches in circumference will absorb half a pound of water and will contract one inch in length. The standing and running rigging of a first rate, measures about 30,000 fathoms and will consequently when wet, contract in length on an average about 833 yards, or nearly half a mile, and absorb about seven tons weight of water, which being principally carried aloft will materially effect her sailing."

Mr. Norris' Miniature Locomotive for the King of France.—Our readers have seen the notice of a beautiful working model of a locomotive made by Mr. Norris for the King of France. The following notice of its performance will prove interesting to the friends of American industry.

The *Journal des Chemins de Fer* gives the following interesting particulars of some experiments to which the model has been lately subjected:—"His Majesty ordered a small railway to be constructed in one of the galleries near the Marine Museum in the Louvre. This construction was about 90 metres long and 36 centimetres wide, presenting all the inequalities of surface that might be met with in a real railroad. The curves were of the smallest radius possible to be used, and such as will never be met with in actual travelling. Repeated trials of the locomotive were made, under the direction of the maker, in presence of his Majesty, surrounded by his family, several ministers, and a number of officers belonging to his household. The little locomotive drew without difficulty a carriage, in which was seated ten persons of his Majesty's suite, amongst whom was General Gourgand, and this was repeated several times with the most perfect success. His Majesty was pleased to express to Mr. Norris the great satisfaction he felt at the success of these interesting experiments, proving as they did that railroads may now be constructed in every description of locality, no natural ground presenting such difficulties as were designedly brought together on this occasion.

Carpets.—The new mill which is in progress of building in this city by the Lowell corporation, is intended for the introduction of new carpet power looms, which is a new invention by a young gentleman of this city. Heretofore, the hand loom alone has been used. By this new invention, one female will be able to do the work of three men. A few of these looms have been in operation for several months, and their complete success placed beyond a doubt.—*Lowell Cour.*

Automaton.—A machinist of a little town in Bohemia, has constructed an automaton, which imitates perfectly the human voice; sings several difficult airs with the greatest accuracy and executes shakes, runs and the chromatic scales with surprising precision. It also pronounces several words in singing.

Professorship of Civil Engineering.—Trinity College Dublin has established a chair and Mr. John Macneill has been appointed.

Wire Bridge.—In our last we gave extracts from a paper read by Mr. A. Smith before the Society of Arts. The following notice refers to the several communications of Mr. S. before the society.

A wire bridge, of 33 feet span, was erected in the room, the construction of which Mr. Smith explained. The wire rope, forming its principal support, weighed 56 lbs.; the angle-irons, 112 lbs.; and the other parts, including the braces, 56 lbs.; and 112 lbs. for the platform or footpath composed of boards—thus making the whole weight only three cwt., and which might be completed by four men, in about three days, at a cost not exceeding 15*l.*, and could, at any time, be taken down or put up in half an hour. These descriptions of bridges were described as very useful for military purposes, and for throwing over deep cuttings in railways etc., Mr. Smith stated, that for general practical purposes the cost might be taken at 1*l.* per foot run, with a breadth of three feet. Two smaller models of bridges, on different principles of construction, were also shown.

Burning Lens worked by the Drummond or Oxy-Hydrogen Light.—A colossal burning lens, three feet in diameter, and weighing 5 cwt., has been erected in the Royal Adelaide Gallery, intended to be worked by the Drummond, or oxy-hydrogen light. Some private experiments of this power of the Drummond light have taken place, when it was found that the bulb of a differential thermometer introduced into the focus, at a distance of 16 ft., was sensibly affected, and a piece of phosphorus introduced in the same point was fused. It has long been asserted that the heat accompanying light obtained by artificial means does not produce heat capable of being transmitted and concentrated through lenses; these experiments fully prove the contrary.

The *tailors* are threatened with the loss of trade, and the thimble and goose to be superseded by the shuttle and loom. Messrs. G. Martin & Co. having introduced into Philadelphia the English invention for weaving coats and pantaloons, and one of the papers speaks of one of their articles as being as comfortable an article of the kind as one could desire for common wear. Drawers and shirts have been woven in that city for some months.

Type Setting Machine.—An instrument invented by M. Gaubert for the purpose of composing and distributing type, has been presented to the Paris Academy of Science, for examination. The Committee in their report give credit to the genius and labor, but carefully abstain from any observation upon its economical use.

The King of France has presented *William Norris, Esq.* our celebrated Locomotive engine manufacturer, a gold medal, and a gold box ornamented with diamonds, besides giving him an order for the construction of several locomotives.

Timber Tank.—A wrought iron cylinder, 51 feet long and 6 feet diameter, has been erected in Portsmouth Dock Yard, for the purpose of "Burnettizing" timber under pressure. It is composed of plates half an inch thick, and double riveted, and the ends are of cast iron, with doors 2 feet 6 inches square, for the admission of logs. It is fitted with two air pumps of 14 inches diameter, for extracting the air, and two force pumps for increasing the pressure when filled with the solution. On a trial lately made before the Admiralty engineer Mr. Kingston, the cylinder having been charged with 20 loads of timber, the air pumps which are arranged to be driven by Lord Dundonald's rotary engine, were set to work, and a vacuum of 26½ inches was obtained in 30 minutes. A cock in the connecting pipe was then opened, and the solution rushed into the vacuum from the cistern. When the cylinder was filled with solution, the force pumps were set to work, and the pressure was raised to 200 lb. on the square inch. Under this pressure there was not the slightest leakage from any part of the cylinder, nor from the doors. The timber was removed on the following day, and a log was cut up, when it was found that the solution had penetrated to the very centre, and completely saturated it. The pressure at which the apparatus is in future to be worked, is 100 lbs. on the square inch, as this is found to be sufficient for the due saturation of the timber within 24 hours, under the process of previous exhaustion of the air. The whole of the work was executed by Messrs. W. Fairbairn and Co., of London, and the cylinder riveted machine, to which its great tightness may be attributed.

Comparative cost of English and Foreign Railroads.—In Mr. Robert Stephenson's elaborate and important report, addressed to the directors of the South Eastern Railway, on the system of railways, as now projected by the French government, he gives an analysis of the cost of railways in England, selecting three lines—the Northern and Eastern, the York and North Midland, and the Birmingham and Derby—as cases similar in their results to those in France now under consideration; from this, and also an analysis of the cost both of the Belgian and French lines, it appears the average cost per mile of the English lines is 25,450*l.*, the French lines, 23,000*l.*, and the Belgian lines, 16,206*l.*; thus showing a difference in the cost in favor of the Belgian lines over the English of no less a sum than 9,244*l.* per mile, and over the French of 6,794*l.*

Barker's Mill applied to Steam Navigation.—Mr. Less delivered a lecture on steam navigation, with a particular reference to the exposition of a principle proposed to be applied by Mr. Ruthven of this city, and for which he has taken out a patent. The lecturer gave a succinct statement of the history and progress of steam navigation, and remarked that the great obstacle to its extension was the imperfect nature of the paddle wheels. It was to obviate this imperfection that Mr. Ruthven had turned his attention, and his plan was sufficiently simple. It was to apply to the propulsion of

the vessel the principle which was known as that adopted in "Barker's Mill." It consists of a tube, horizontal or upright, into the extremity of which another tube, crossing it at right angles, was fitted, and open at both ends. When water was introduced into the first tube, it naturally made its escape at the two ends of the angular tube, but in its escape it caused this tube to revolve ; the water, as it escaped, sending the tube forward in an opposite direction to that by which it escaped, and this with a force proportioned to the pressure of the water. The principle, in fact, is precisely the same as that which causes the recoil in a gun when it is discharged. It had been attempted to be applied to steam navigation before, but had always failed, because, in the lecturer's estimation, the water was always discharged below the surface, which impeded its power of action. He illustrated this by experiments, which certainly showed that the discharge of the water, below the surface of other water was not nearly so efficient as when it was discharged into the air. The mode of its application to the propulsion of vessels, was as we understood, by making apertures in the bows of the ship, through which the sea water would flow into pipes, and thus would be conducted to the place where the steam-engine was situated. There the water would escape by a large pipe running across the vessel and open at both ends, but with the apertures directed towards the stern, which upon the principle referred to, would have the effect of sending the vessel forward. If it was wished to back the vessel the aparatus could be turned in the contrary direction ; and if to stop her, they had only to be turned directly down towards the bottom, while the engine never ceased working. In this case, we understand, the use of the engine would be to discharge the water out at the two apertures with a high degree of pressure as the speed of the vessel would be in proportion to the rush of the water. A small model was exhibited without a steam-engine, which showed the soundness of the principle, by the small skiff sailing, backing, and even turning, in water. The lecturer considered that vessels propelled in this way would have more velocity than those propelled by the paddle, besides the great advantage of dispensing with that imperfect implement.—*Edinburgh Courant.*

The Numeral Figures.—The types from which numerals are printed were, from the invention of printing till about 1785, formed so as to give heads, and tails to the figures, in the manner which is always used in handwriting. At the period just named, Dr. Hutton introduced in his logarithmic tables what was then a new form, in which the figures were all of one size, having no parts above or below the others. This system of Dr. Hutton's gradually became universal, much to the regret of all who had to consult mathematical tables, who were glad to use French tables, in preference to English, on account of the surperiority of heads and tails. In the mean time, it was found that with figures all of a size, a larger type was necessary, to secure sufficient legibility, and this type gave facilities to that formation of thick and thin lines which distinguishes

the larger numerals of the existing English press from those of all other ages and countries:

1234567890

It was generally admitted that both circumstances,—the sameness of size, and the swelling of the lines which compose the figures, were unfavorable to legibility; but no steps were taken to restore the old type until lately, when some works were published in what was called the *French brevier*, being a type in which the heads and tails exist, and in which the thickness is as nearly as possible the same throughout. The Council of the Royal Astronomical Society and the superintendent of the Nautical Almanac, have recently come to the determination to restore the old form of the numerals in their respective publications, an example which is pretty sure to be followed in mathematical publications, and perhaps in others.

Deleterious Gas Detector.—An invention is described in the French papers which will, it is said, give such timely notice of the presence of deleterious gas in mines, or other places, as will enable persons to take the necessary precautions to guard against explosions. An explosion from the admixture of carburetted hydrogen with atmospheric air can only take place when the former exists in a certain and know proportion. When the quantity has reached or exceeded this point, the contact of a light instantly causes an explosion. The instrument recently invented has a sort of tell-tale to show the existence of danger, is simple, ingenious, and effectual. Connected with a chemical solution is a kind of float, nicely graduated, and attached to a counterpoise. The solution is of such a nature that it undergoes a change when acted upon by the admixture of carburetted hydrogen, and when saturated to a certain point the float changes its position, and acting in its turn upon the counterpoise, a spring is let loose, and strikes upon a bell or drum, giving out a loud sound, and thus indicating the presence of danger. This ingenious test is not liable to derangement, and the whole apparatus is comprised with a small compass, and of little cost. The solution can be varied so as to be adapted to every kind of deleterious gas.

Architectural Remains in Asia.—The *Commerce* states, that "most favorable news had been received from M. Tessier, appointed to direct the expedition sent to Magnesia, in Asia Minor, in order to raise the remains of the temple of Diana Leucophica. It appears that many more objects had been discovered than was originally expected, amongst others several columns in complete preservation, with their capitals sculptured with extreme delicacy, besides 12 bas-reliefs admirably executed, and a number of statues. The most friendly aid had been afforded by the French authorities in the Levant, and it is expected that a brilliant harvest is being reaped for the Academy des Beaux Arts at Paris."

Erratum.—On page 34, 16 lines from the top for "exchange" read "*enhanced.*"